"MEPHISTO" BITS HOW THEY ARE MADE

By S. A. Hand, ASSOCIATE EDITOR, AMERICAN MACHINIST

The manufacture of auger bits is one of the oldest of the tool industries in this country. Many of the factories have remained in the families of their founders for generations and, as is usual in such cases, radical improvements in either the product or the processes of manufacture have been slow. The bit described in this article has been improved, not by adding anything to it but by taking something from it. Some of the processes in its manufacture are different from those generally used in bit making. Boring is only whittling in a circle and just as one uses only one blade with which to whittle so it is only necessary to have one cutting blade on an auger bit. Likewise, it is only necessary to have one scoring lip to cut off the chip.

THE steel used in the auger bits made by the W. A. Ives Manufacturing Co., Wallingford, Conn., is made to its own specifications using genuine Swedish pig as a base. It has a slightly higher content of manganese than of carbon, to give stiffness; while for endurance of cutting edges, a trace of tungsten is added.

The blanks for the bits are sheared from a flat bar of suitable size, and after being heated the shanks are drawn out and the squares formed in dies in high-speed Bradley hammers as may be seen in Fig. 1. Next, the blade is die forged in the same type of hammer. In this operation, known as plating, the blade is left thicker at the center than at the edges, the shape being similar to that of a slitting or feather-edge file. This shape is not carried out to the extreme end, a blank space about twice as long as the width of the blade being left for drop-forging the leader-screw blank and scoring lip and to leave enough thickness of metal for forming the cutting lip. The appearance of this end after drop-forging may be seen in Fig. 2, in which *A* is the blank for the leader screw, *B* the scoring lip and *C* the part from which the cutting lip is upset. It will be noted that an unusually large flash is left from the drop-forging operation. This is to insure the maximum compression of metal at the vital part of the bit and to make certain that any accidental overheating of the metal at the edges and extreme end will not affect the cutting parts. Trimming off the flash is done in an ordinary punching machine provided with suitable dies.

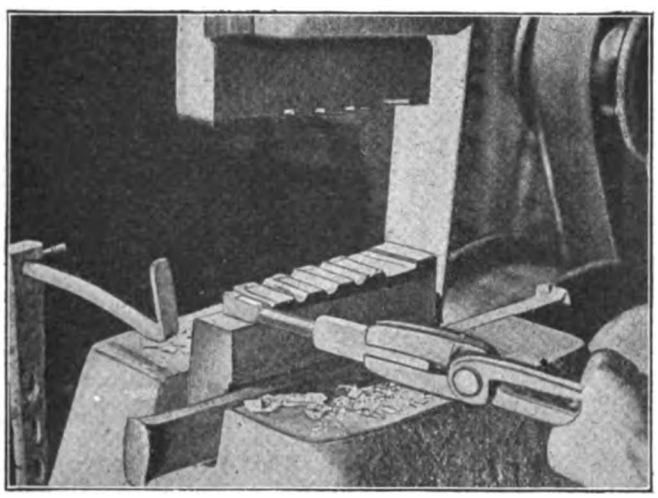

FIG. 1. FORGING THE SHANK

The appearance of the bit blank after it has gone through the operations described is shown in Fig. 3. *A* is the blank as cut off by the shears; *B* has the shank drawn out and the square formed; *C* shows the blade after plating. Here the thickened center and the flat at the end left for drop-forging may be seen. *D* shows the result of the drop-forging operation, and *E* represents the appearance after the flash has been trimmed.

Crimping or twisting the blade is illustrated in Fig. 4. The cutting end of the hot blank is inserted in the chuck *A*, the rear end of the blade being supported in the fork *B* while the square on the shank is held by tongs in the operator's left hand. With his right hand, the operator turns a crank connected to the spindle of the machine. Twisting is continued until in the judgment of the operator the number of turns and the lead are correct, no hard-and-fast rule being followed. Operators on this work, however, become so expert that the results are very uniform.

Bits for boring treenail holes in wooden-ship construction and for other deep-hole work are not twisted but are crimped between dies in a machine of the bull-dozer type. Such bits must have the bottoms of the crimps accurately formed so that the chips will be brought out of the hole and not clog the bit.

After twisting, the bit is reheated at the end and headed. In this operation both the cutting and scoring lips are formed in dies, the action of the machine being similar to that of a bolt-heading machine. The next step is to even up the twist between dies in the lever-operated fixture, Fig. 5, after which the bit is cold-straightened.

The blank for the leader screw is hollow-milled to size and shape in a hand lathe and the outside diameter is ground to size. In this latter operation the bit is held in a chuck in the live head of the machine, Fig. 6, and supported at the other end by a female center into which

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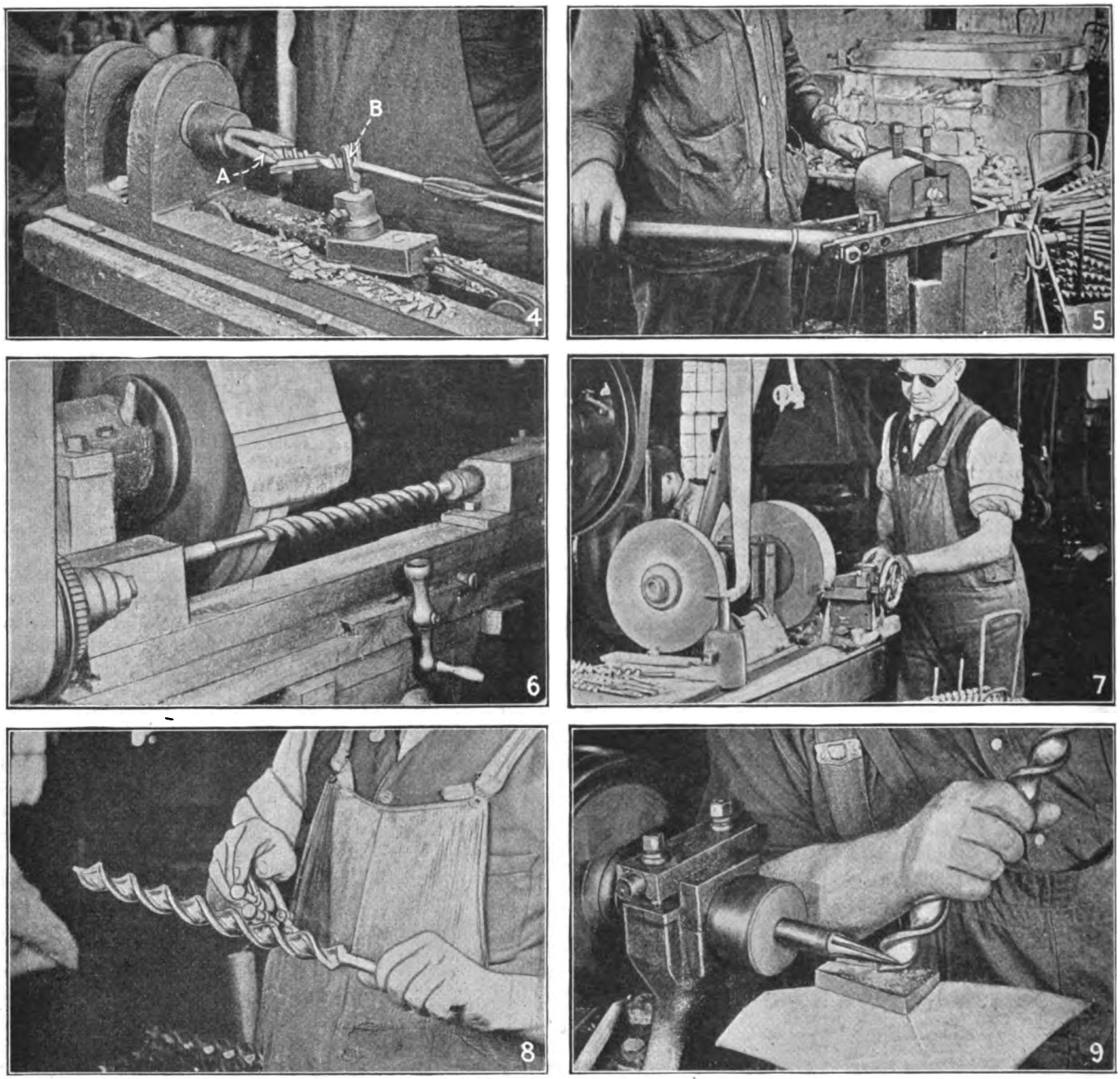
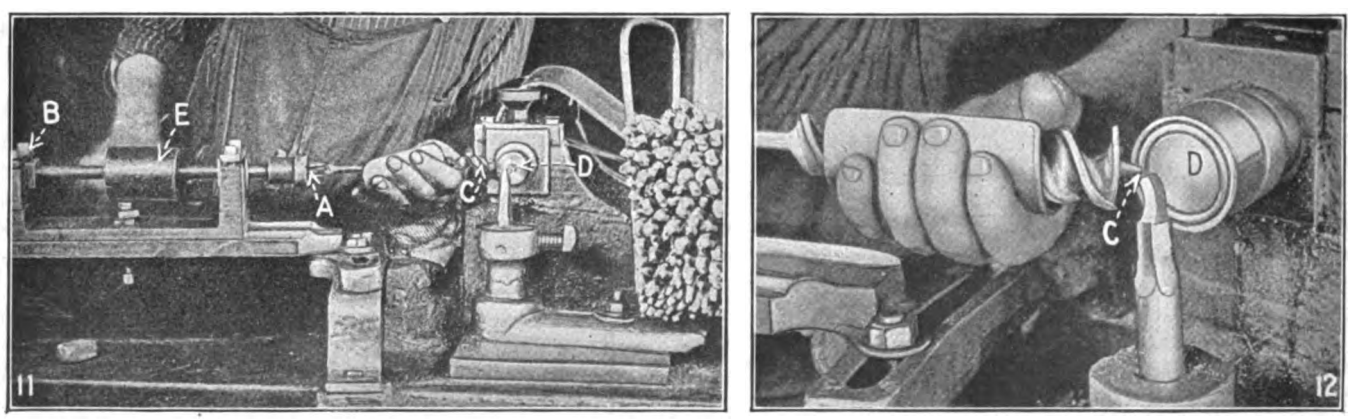


FIGS. 4 TO 9. TWISTING, SIZING AND THROATING

Fig. 4—Twisting the bit. Fig. 5—Evening the crimps. Fig. 6—Grinding to size by a friction wheel. Fig. 7—Grinding the clearance. Fig. 8—Measuring the clearance. Fig. 9—Digging out the throat.

the blank for the leader screw fits. The action of the machine is similar to that of any cylindrical grinding machine except that the actual grinding is not done by an abrasive wheel, as would naturally be supposed, but by a steel wheel running at a very high peripheral speed. The removal of metal from the bit is by fric-



FIGS. 11 AND 12. CUTTING THE LEADER SCREW

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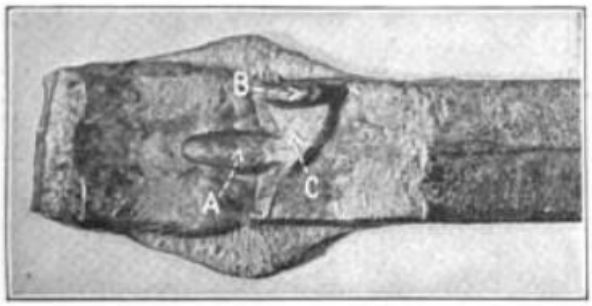


FIG. 2. THE DROP-FORGED HEAD

tion. There seems to be little wear on the wheel which is evidenced by the fact that the wheel now on the machine has been in constant use for about 17 years. The outside of the bit must be reduced in diameter behind the cutting point for clearance and the operation is performed, as shown in Fig. 7, on an ordinary abrasive grinding stand, the bit being revolved by hand between the abrasive wheel and an adjustable slide. Fig. 8 shows an inspector gaging the clearance with an adjustable limit gage.

Both the cutting lip and the blank lip opposite to it are faced back to form a tangent with the leader-screw blank and their tops are leveled off, all on hand milling machines. The throat under the cutting lip is "dug out" by milling to form the chip carrier. This operation is illustrated in Fig. 9, in which it will be noticed that the bit is being guided entirely by the workman's hands.

Various Stages the Bit Passes Through

Fig. 10 shows the stages the bit has passed through from the crimping until it is ready for cutting the thread on the leader screw. Referring to the illustration: *A* has been crimped; *B* has been headed and the blank for the leader screw hollow-milled; *C* has been ground on the outside and for clearance; *D* has been faced back; *E* has been leveled on top, and *F* has had the throat dug out.

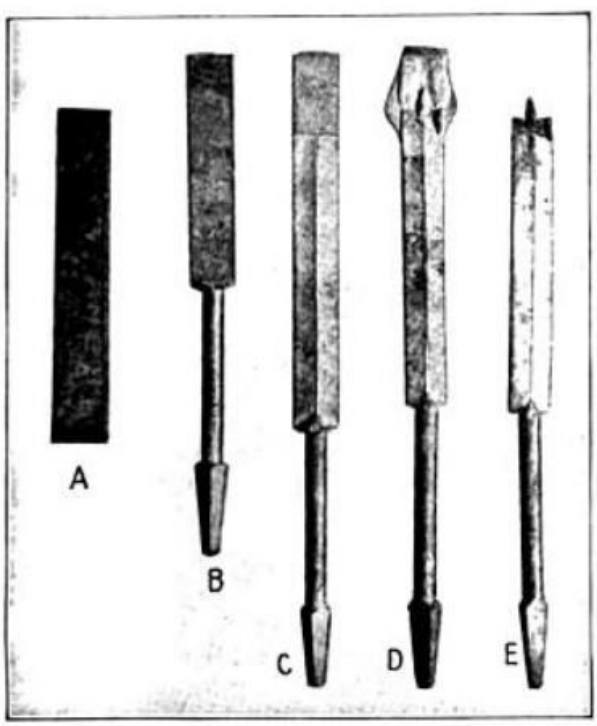


FIG. 3. OPERATIONS BEFORE TWISTING

Figs. 11 and 12 show how the threads on the leader screw are formed. The square shank of the bit is held in the chuck *A*, Fig. 11. The spindle supporting this chuck is threaded at its rear end to the same pitch as the screw to be formed and is free to revolve in the nut *B* which also acts as a back bearing. The leader-screw blank is supported by the rest *C* and drawn up by hand against the concentrically grooved steel disk *D* which

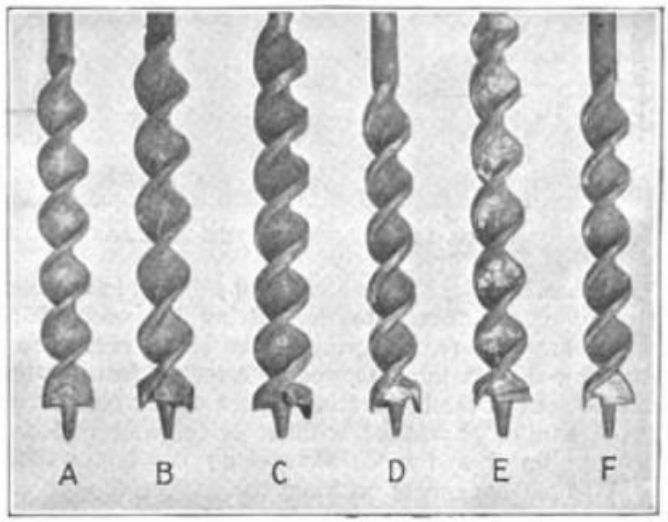


FIG. 10. SOME OPERATIONS AFTER TWISTING

runs at 8000 r.p.m. While the operator holds the leader-screw blank tightly against the disk with his left hand he rotates the spindle in one direction by rolling his right hand and arm over the wooden roll *E*; and

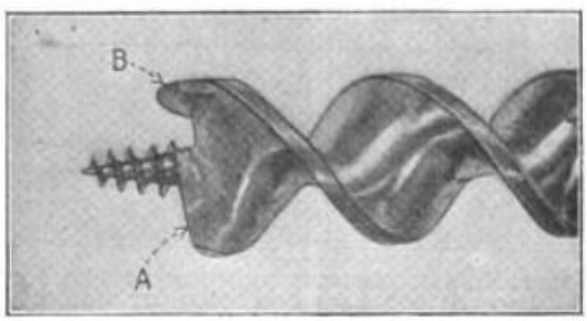


FIG. 13. A FINISHED LEADER SCREW

then relieving the pressure, rotates the spindle in the opposite direction by a reverse motion of his hand and arm, lead being given to the screw by the thread and nut at the rear. The thead is formed by friction between the leader-screw blank and the rapidly revolving disk and during the operation the leader-screw blank becomes red hot.

Relation of Leader Screw to Cutting Lip

Bits are made with leader screws of different pitches —varying from 10 per inch for bits used by electricians, where the object is to bore a hole quickly without regard to its smoothness, to 18 per inch for bits used by pattern and cabinet makers and for use in power-driven machines.

A finished leader screw is shown in Fig. 13 where it will be noticed that the cutting lip *A* is a continuation of the last thread. This construction is the secret of making a bit that will bore a hole clear through a board without requiring end pressure after the screw

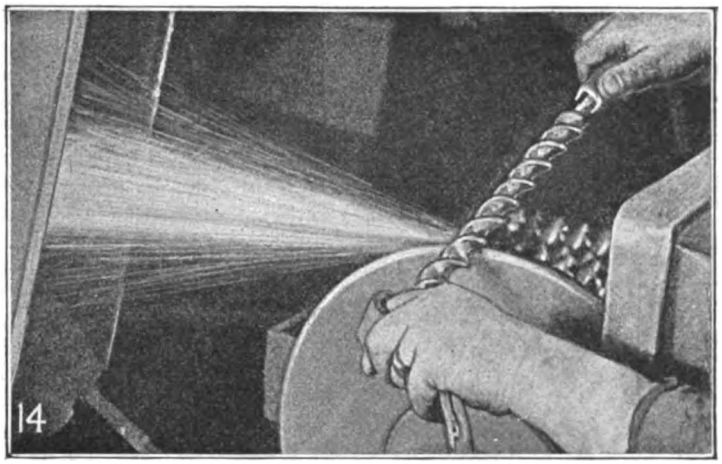


FIG. 14. POLISHING THE HOLLOW

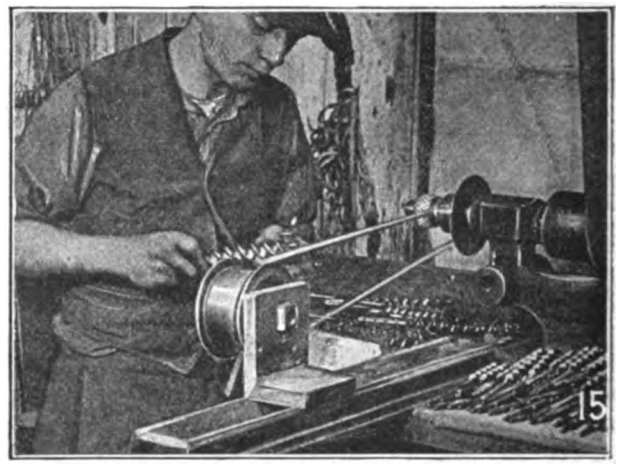
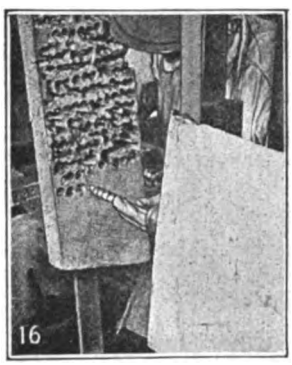
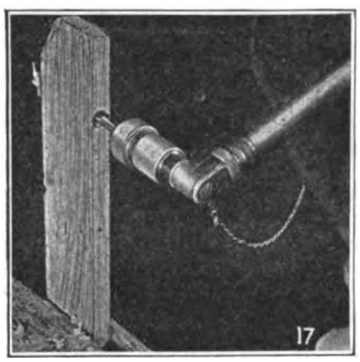


FIG. 15. POLISHING THE THROAT

has taken hold. If there should be a break in the continuity of the thread to the cutting lip, small chips would lodge there, and prevent the leader-screw from drawing the bit into the wood. Another feature that can be seen in the illustration is that the single cutting lip *A* can be sharpened without interfering with the scoring lip *B* and when sharpening the latter there will be no danger of nicking the cutting lip of the file.

Several more operations are necessary before the bit is hardened and tempered, but as they are mostly such





FIGS. 16 AND 17. BRIGHTENING THE LEADER SCREW AND TESTING A BIT FOR STRAIGHT BORING

operations as are generally performed in every-day practice only two of them are illustrated. Fig. 14 shows how the hollows in the twist are polished on a vulcanized abrasive wheel and Fig. 15 illustrates finishing the throat on an endless abrasive belt.

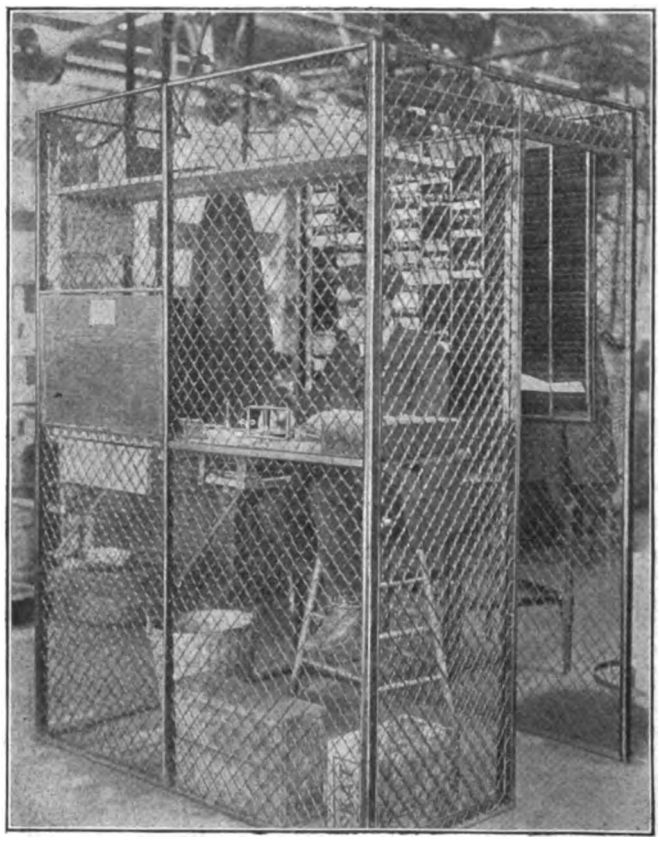
After hardening and drawing the temper, each bit is honed and carefully inspected. The leader screws are then polished by dipping them in oil and an abrasive and repeatedly screwing them in and out of a piece of apple wood as may be seen in Fig. 16. Every bit is tested in actual boring, and as a proof that a well-made bit will bore straight, Fig. 17 shows a bit finishing the boring of a $\frac{1}{8}$-in. hole edgewise through a 1-in. board.

Timekeeper's Cage

By Fred H. Colvin

The illustration shows the method used by the White Tractor Co., Cleveland, Ohio, for locating the routing or job-distribution office in any part of the shop which may be most convenient to the work. This cage, as can be seen, consists of practically standardized sections of heavy wire netting, including a sliding door, which is provided with a lock to prevent the cards or other records being maliciously or mischievously disturbed.

This cage contains the rack for the job tickets and also a calculagraph for recording the time of starting and stopping the various jobs. The small opening in front of the timekeeper is large enough for the passage of job tickets, while the board at the left can be let



A CAGE FOR TIMEKEEPING RECORDS

down to form a shelf, should this be more convenient at any time.

The advantage of a cage of this kind is that it can be placed in any department and in almost any location in the shop without interfering in any way with the light or ventilation of the department. If can also be moved whenever desirable.

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